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1.	Your reference	SJA/60268/0000
		27JUN02 E728913-8 D02882 ~~P01/7700 0.00-0214793.2~~
2.	Patent application number *(The Patent Office will fill in this part)*	0214793.2
		26 JUN 2002
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	DISPERSE TECHNOLOGIES PLC Surrey Research Park 40 Alan Turing Road Guildford, Surrey, GU2 7YF
	Patents ADP number *(if you know it)*	8164246002
	If the applicant is a corporate body, give the country/state of its incorporation	United Kingdom
		SECTION 30 (1977 ACT) APPLICATION FILED 23/8/02
4.	Title of the invention	BILIQUID FOAM ENTRAPMENT
5.	Name of your agent *(if you have one)*	BOULT WADE TENNANT
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	VERULAM GARDENS 70 GRAY'S INN ROAD LONDON WC1X 8BT
	Patents ADP number *(if you know it)*	42001
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country / Priority application number (if you know it) / Date of filing *(day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application / Date of filing *(day / month / year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or* [illegible]	Yes

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Claim(s)	3
Abstract	-
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Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(Please specify)*	

11 I/We request the grant of a patent on the basis of this application.

Signature: Boult Wade Tennant

Date: 26 June 2002

12. Name and daytime telephone number of person to contact in the United Kingdom — S.J. ALLARD 020 7430 7500

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BILIQUID FOAM ENTRAPMENT

The present invention relates to biliquid foam entrapment and, in particular, to a biliquid foam entrapped within a matrix of a polymeric material which is in the form of a discrete powder.

The entrapment of oils or oil soluble substances (especially perfumes and coloured dye precursors) in microcapsules and their subsequent coating onto paper and other surfaces is well known in the art. Microcapsules of this type comprise individual droplets of oil or oil soluble substances (of size ranging from sub-micrometre to tens of millimetres in diameter) around which polymer walls have been formed by one of a number of chemical processes. Usually such microcapsules are prepared as an aqueous suspension which is then capable, with the addition of suitable modifying reagents, of being sprayed or printed onto paper and other surfaces. The object in so doing is usually to prevent the evaporation of volatile substances (for example, perfumes) or the degradation or chemical reaction of oil soluble species (for example, colourless dye precursors) until the microcapsules are broken by the application of shear forces by scratching or scraping the coated surface with the consequent release of their contents. Such coatings find major uses, for example, in the forms of "scratch and sniff" perfume coatings or NCR (No Carbon Required) paper.

However, these microcapsules suffer from a number of disadvantages.

Firstly, the process by which microcapsules are formed is a lengthy and uncertain one in which control over temperature, pH and the absence of any form of contamination is essential. The formation of microcapsules, for example, by complex coacervation [illegible]

gum acacia takes many hours and demands very close control of pH, temperature and cooling rate. Similarly, the formation of microcapsule walls from aminoplast resins, such as melamine-formaldehyde or urea-formaldehyde takes at least eight hours during which precise control over all controllable parameters needs to be effected. Moreover, the effectiveness and completeness of any individual encapsulation process (and therefore the quality of the microcapsules so formed) depends largely on the chemical nature of the oil and/or oil soluble substances being encapsulated.

A further disadvantage of microcapsulation is that the thickness and therefore the strength of the microcapsule wall is variable and is not easily controllable and varies with the nature of the oil or oil-soluble substances being encapsulated. Thus microcapsules made by the same process but from different oils may have widely differing strengths and resistance to breakage during the printing process and during subsequent storage and use.

A yet further disadvantage of microencapsulation is the limited number of chemical processes and the limited number and type of polymeric wall materials which are available to form them. The choice as to the properties of the wall materials is consequently limited with regard to their flexibility, tensile strength, permeability, chemical inertness, mammalian toxicity and other properties including solubility and melting point (if any). In addition, some of the chemicals commonly used in the wall forming process are themselves highly irritating and may themselves be toxic such, for example, as the use or release of formaldehyde (a potential carcinogen) during the manufacture of aminoplast resin walls. Moreover, the remaining traces of formalin in the resulting microcapsule suspension are virtually impossible to eliminate to below acceptable levels for uses of

microcapsules and requires special precautions to be taken during the manufacturing process.

Whilst many of the processes to produce microcapsules produce dispersions of the microcapsules in a fluid medium, they can also be produced in the form of a powder.

Other methods of encapsulating oil within a powder are generally based upon the drying of an oil-in-water dispersion. Examples of this prior art include EP-B-0938932 which discloses a process for manufacturing a cosmetic and/or dermatological powder in which an oil-in-water dispersion comprising at least one modified starch is dehydrated to form a powder and US-A-6129906 in which a granular powder is formed by spray drying an aqueous dispersion of a silicone oil and a water-soluble carrier, the silicone oil being present in the dispersion as discrete droplets having a droplet size in the range of from 0.5μm to 20μm.

WO 99/05299 discloses a surface coating in which droplets of a non-polar substance are trapped within a polymer film, the surface coating being prepared by drying a dispersion of a film forming polymer containing droplets of a suspended biliquid foam or emulsion. Surface coatings only are disclosed and this reference does not teach the drying of the dispersions to form a powder.

We have now developed a discrete powder which is based upon the encapsulation of a biliquid foam.

Accordingly, in one aspect of the present invention provides a discrete powder which comprises particles in which a biliquid foam has been entrapped within a matrix of a polymeric material.

In another aspect the present invention provides a process for the preparation of a discrete powder which comprises a biliquid foam entrapped within a [illegible]

comprises the steps of:

i) preparing a biliquid foam,

ii) forming a dispersion of the biliquid foam in an aqueous solution, suspension or dispersion of a polymeric material, and

iii) subjecting the dispersion to drying under conditions such that a discrete powder is formed.

The discrete powder of the present invention is preferably produced by spray drying of the dispersion.

Biliquid foams are known in the art and are described in the following literature references by Sebba: "Biliquid foams", J. Colloid and Interface Science, 40 (1972) 468-474; and "The Behaviour of Minute Oil Droplets Encapsulated in a Water Film", Colloid Polymer Sciences, 257 (1979) 392-396. Neither of these articles suggest that biliquid foams might be used in the preparation of spray dried powders.

US Patent No. 4486333 to Sebba describes a particular method for the preparation of biliquid foams by agitating a hydrogen bonded liquid containing a soluble surfactant to produce a gas foam and intermittently adding to the gas foam a non-polar liquid which is immiscible with the hydrogen bonded liquid, the surfactant-containing hydrogen bonded liquid being selected to provide a spreading coefficient equal to or greater than zero.

The oil-based biliquid foam used in the spray dried powders of the present invention will preferably comprise from 70 to 95% by weight of the oil phase and from 5 to 30% by weight of the continuous phase. A surfactant to stabilise the biliquid foam may also be included in an amount of from 0.01 to 3%, preferably from 0.1 to 1% based on the total weight of the biliquid foam. The surfactant may dissolve in either the oil phase, the continuous phase or both phases of the biliquid foam.

Oils which may be used in the biliquid foam will in general be substantially water immiscible and liquid at room temperature and may be, for example, a cyclomethicone, dimethicone, phenyl trimethicone, dimethiconol, dimethicone copolyol, trimethylsiloxysilicate, an emollient ester such as isopropyl isostearate, lanolate, myristate or palmitate, or octyl palmitate, a glyceride such as avocado oil, coconut oil, soybean oil or sunflower oil, or a caprylic/capric triglyceride, a lanolin oil, orange oil, mineral oil or natural oil, or oleyl alcohol, or any other oil generally known for this purpose, or mixtures of the foregoing.

It will be understood that the oil phase of the biliquid foam may contain or consist of one or more active ingredients such as fragrances, flavours, perfumes, pharmaceuticals, sunscreens, dyes, sunstreams, pesticides etc.

The biliquid, foam may contain, as described above, a low level of a surfactant which may be, for example:-

a cationic surfactant such as an amidoamine, a quaternary ammonium compound or a sulphonium salt;

an amphoteric surfactant such as an acylamino-acid, an N-substituted alkylamine, an <u>N</u>-alkyl-β-amino-propionate, an <u>N</u>-alkylbetaine, an alkylimidazoline or a sulphobetaine;

an anionic surfactant such as an acyl-lactate, <u>N</u>-acylsarcosinate, alkyl-carboxylate (either mono- or polyvalent), alkyl ether carboxylate, <u>N</u>-alkyl-glutamate, fatty acid-peptide condensate, phosphated ethoxylated alcohol, alkyl sulphate, ethoxylated alkyl sulphate, alpha-olefin sulphonate or ester-linked sulphonate;

a nonionic surfactant such as an alkanolamide, amine oxide, ester of a polyhydric (for example an [illegible]

or glycerol or a polyglycerol, or sorbitan, glucose or sucrose), a polyoxyethylene or polyoxypropylene derivative of an alcohol, amide or ester, or a polyoxyethylene/polyoxypropylene block copolymer;

or a suitable compatible mixture of these surfactants.

The continuous phase of the biliquid foam is generally an aqueous phase which may include therein a substantial level of a C_1-C_4 (water miscible) alcohol, or ethylene glycol or mixtures thereof.

The continuous phase of the biliquid foam may include therein preservatives, stabilizers or other materials known in the art.

Methods of producing biliquid foams are described in US-A-4486333 involving the preliminary formation of a gas foam in order to provide a sufficiently large surface area on which the biliquid foam can subsequently be formed. It has been found that the prior formation of a gas foam is not required to manufacture a stable biliquid foam, provided that a suitable stirring mechanism is provided in the manufacturing vessel. An aspect of the present invention is the ability to manufacture biliquid foams without the preliminary formation of gas foam, by the use of a tank incorporating a suitable stirring mechanism.

Such an apparatus comprises a tank provided with a stirrer in which the stirrer blade breaks the interface between the liquid and air. A delivery device is provided through which the oil phase (water immiscible liquid), which will comprise the internal phase of the dispersion is delivered to the tank. The design of the delivery device is such that the rate of addition of the internal phase fluid can be controlled and varied during the production process. A feature of the production process is that the internal (oil) phase is added to the stirred aqueous phase slowly at

first until sufficient droplets have been formed to constitute a large, additional surface area for the more rapid formation of new droplets. At this point, the rate of addition of the oil phase may be increased.

The production process consists of the following steps:

1. The addition of one or more chosen surfactants to one or other or both phases (as previously determined by experiment).
2. The charging of the aqueous phase into the bottom of a process vessel.
3. The incorporation of the stirrer into the vessel so that it stirs the surface of the aqueous phase.
4. Adjustment of the stirrer speed to a previously determined level.
5. The slow addition of the internal phase whilst continuing to stir at the prescribed speed.
6. The speeding up of the rate of addition of the oil phase once a prescribed amount (usually between 5% and 10% of the total amount to be added) has been added.

The stirring rate and the rate of addition of the oil phase are variables, the values of which depend upon the detailed design of the manufacturing plant (in particular, the ratio of tank diameter to impeller diameter), the physico-chemical properties of the oil phase and the nature and concentrations of the chosen surfactants. These can all be pre-determined by laboratory or pilot plant experiment.

It will be understood by those skilled in the art that other manufacturing methods may be used to produce the biliquid foams, as appropriate.

forms a discrete powder. Water-dispersible or water-soluble film forming polymers of many types are well known and include cellulose derivatives (for example, carboxymethylcellulose, hydroxyethylcellulose, cetylhydroxycellulose, hydroxypropylcellulose, hydroxypropylmethylcellulose, hydroxyethylmethylcellulose and methylcellulose), gelatin, gum arabic, gum acacia, gellan gum, shellac, carragenan, natural starches, modified starches, xanthan gums, alginates, dextrins, polyvinyl alcohol, polyvinyl pyrollidone or polyamides and other water dispersible or water soluble film forming agents known in the art. The present invention may include the use of all the above singly or in combinations.

In carrying out the process of the present invention for forming a discrete powder the suspension of the biliquid foam in an aqueous solution, suspension or dispersion of the polymeric film is dried under conditions such that a discrete powder is formed. Preferably the said dispersion is spray dried. The choice of suitable spray drying conditions will be within the knowledge of a person skilled in the art and will depend upon various factors, including the melt temperature of the polymeric material, the amount of water contained in the dispersion, the ratio of polymeric material to the biliquid foam etc. Generally the inlet temperature for the spray dryer will be in the range of from 180° to 210°C and the outlet temperature will be in the range of from 85 to 110°C.

Typically, in carrying out the present invention the biliquid foam will have a droplet size in the range of from 5 to 45 micrometres. A biliquid foam having such a droplet size can generally be produced under low shear conditions. For the purpose of the present invention the mean droplet size of the biliquid foam should preferably be further reduced to

below 12 micrometres, for example by using higher shear conditions.

The biliquid foam is then mixed with an aqueous solution, suspension or dispersion of the polymeric material under conditions which generate a homogeneous dispersion. For example, using gentle stirring or using a high-shear device, such as a Roto Stator mixer.

It will be understood that although spray drying is the preferred method of producing the discrete powders of the present invention, other drying techniques, such as freeze drying can also be used.

The discrete powders of the present invention generally incorporate high levels of oil entrapped with the polymeric material, typically from 20 to 40% by weight based on the weight of the powder.

The discrete powders of the present invention will generally have a particle size in the range of from 5 to 100μm.

The invention provides a means of controlling the rate of release of the oil entrapped within the polymeric material by exercising control over the concentration and ratio to the biliquid foam of the film forming polymer in solution or suspension and thereby controlling the thickness and strength of the film forming the outside of the particles.

The invention also allows for release of the oil by dissolution of the film by contact with water or other polar solvent. In addition, the water-soluble or water dispersible film forming polymer may be partially or wholly crosslinked to render it partially or totally water insoluble by which means the rate of release of the entrapped biliquid foam may be controlled by the speed or absence of dissolution when the powder makes contact with water or other polar [illegible]

be such that it is sensitive to acidity or alkalinity so that the release of the entrapped oil may be determined by a change of pH or by the presence of another chemical species with which the film-forming polymers may react, so rendering it permeable or unstable. The powder may alternatively comprise a polymer which melts at a known and predetermined temperature to release the entrapped oil.

In one embodiment, the entrapped biliquid foam may comprise a perfume which, when dried into a discrete powder will behave and perform precisely as a conventional, microencapsulated "scratch and sniff" perfume as previously described. Furthermore, an encapsulating polymer may be chosen that allows the release of the perfume by diffusion over time, such as in a room fragrancing device.

In another embodiment, a perfume or deodorising composition is entrapped according to this invention in a discrete powder which is incorporated into a diaper or incontinence pad during manufacture so that the perfume or deodorising fluid is released on contact with water when the diaper or incontinence product is used, thereby masking or neutralising any disagreeable odour.

In another embodiment, the biliquid foam may be entrapped in water soluble polymer powder particles on a suitable applicator together with other reagents (for example, an abrasive material, such as a pumice or water soluble antimicrobial agents) to form a dry surface which, when wetted, becomes an effective hard surface cleaning product.

In yet another embodiment, the matrix forming polymer may comprise a brittle film which ruptures easily when deformed so releasing the entrapped non-polar substance. In one application of this embodiment, the powder may be coated onto a flexible film which may, for example, be shrunk onto the cap of

a consumer product such that if the flexible film is removed, the particles rupture so releasing the non-polar substance which, in this instance, may be the colourless precursor of a coloured dye which, on release, undergoes a chemical change to become highly coloured. This embodiment thereby gives a clear indication as to whether or not a closure has been tampered with.

The present invention will be further described with reference to the following Examples.

PREPARATION OF BILIQUID FOAMS

<u>Preparation 1</u>

A biliquid foam was prepared from the following ingredients.

Ingredients	Weight (g)	%
Aqueous Phase		
Water	396	9.9
Sodium lauryl ether sulphate	4	0.1
Oil Phase		
Volpo L3	36.4	0.9
Medium viscosity white mineral oil	3563.6	89.1
Total	4000	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase and stirring with a flat bladed stirrer at 300 rpm until the mean droplet size was 15-20 micrometres.

A 1kg sample was removed and this was stirred with a flat bladed stirrer at 500 rpm until the mean droplet size was 11 micrometres.

Preparation 2

Ingredients	Weight (g)	%
Aqueous Phase		
Water	148.5	9.9
Tween 20	1.5	0.1
Oil Phase		
PEG25 castor oil	13.5	0.9
KMC	1269.7	84.65
Pergascript Red I-6B	66.8	4.45
Total	1500.0	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase and stirring with a flat bladed stirrer at 116 rpm. The mean droplet diameter was 35 micrometres. The stirrer speed was then increased to 250 rpm and stirred until the mean droplet size was less than 12 micrometres.

Preparation 3

Ingredients	Weight (g)	%
Aqueous Phase		
Water	47.67	9
Sodium lauryl ether sulphate	0.53	0.1
Oil Phase		
Laureth 3	4.77	0.9
Dow Corning 200 50cst	476.74	90.0
Total	529.71	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase whilst stirring with a flat bladed stirrer at 200 rpm for 45 minutes.

Preparation 4

Ingredients	Weight (g)	%
Aqueous Phase		
Water	44.97	9
Sodium lauryl ether sulphate	0.5	0.1
Kathon 1CG II	0.03	0.006
Oil Phase		
Oleth 10	4.5	0.9
Orange oil	450.0	90.0
Total	500	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase whilst stirring with a flat bladed stirrer at 200 rpm for 45 minutes.

Preparation 5

Ingredients	Weight (g)	%
Aqueous Phase		
Water	52.60	9.8
Sodium lauryl ether sulphate	0.532	0.1
Kathon 1CG II	0.026	0.0048
Oil Phase		
Etocas 25 (PEG25 Castor oil)	4.78	0.9
Rose oil fragrance L301844	478.44	89.2
Total	536.378	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase whilst stirring with a flat bladed stirrer at 200 rpm for 45 minutes.

Preparation 6

Ingredients	Weight (g)	%
Aqueous Phase		
Water	14.85	9.9
Tween 20	0.15	0.1
Oil Phase		
Oleth 10	1.35	0.9
Octyl methoxy cinnamate	133.65	89.1
Total	150	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase whilst stirring with a flat bladed stirrer at 200 rpm for 45 minutes.

Preparation 7

Ingredients	Weight (g)	%
Aqueous Phase		
Water	11.29	8.79
Tween 20	0.26	0.20
Oil Phase		
PEG25 castor oil	0.64	0.5
Oleth 10	0.64	0.5
Household Fragrance oil	115.55	90
Total	128.38	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase whilst stirring with a flat bladed stirrer at 200 rpm for 45 minutes.

Preparation 8

Ingredients	Weight (g)	%
Aqueous Phase		
Water	9	9
Laureth 23	1	1
Oil Phase		
Gransil GCM-5	49.24	49.24
Cetearyl isonanoate	7.78	7.78
Isopar K	7.78	7.78
Dow Corning 200 50cst	0.97	0.97
Gransil DMCM-5	24.25	24.25
Total	100	100

The biliquid foam was prepared by adding the oil phase to the aqueous phase and stirring with a flat bladed stirrer at 174 rpm. The stirrer speed was increased to 300 rpm to help with the inclusion of the oil before continuing to stir at 174 rpm until the mean droplet size was 11 rpm.

Preparation 9

Ingredients	Weight (g)	%
Aqueous Phase		
Water	9.9	9.9
Tween 20	0.1	0.1
Oil Phase		
Ibuprofen	4.5	4.5
Isopropyl myristate	84.5	84.5
Laureth 3	1	1
Total	100	100

The biliquid foam was prepared by adding the oil phase (ibuprofen fully dissolved in the isopropyl myristate) to the aqueous phase and stirring with a flat bladed stirrer at 174 rpm. The preparation was stirred after the inclusion of the oil until the mean [illegible]

Preparation of Dispersions and Spray Drying

EXAMPLE 1

The dispersion was prepared by stirring the biliquid foam into the aqueous polymer immediately before spray-drying.

Ingredients	**Weight (g)**	**%**
Preparation 1	76.9	7.7
Gum acacia (30% by weight in demineralized water)	923.1	92.3
Total	1000	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	34.6%
Oil: polymer (dry basis)	20:80
Inlet/outlet temperature	200°C/95°C
Yield	85.2%
Comment	
Product Characterisation	
Nature of dry particle	Fine powder
Oil encapsulation	Good
Oil release	Moderate amount of loose oil visible on release.
Mean droplet size before spraying	1.99μm

EXAMPLE 2

The dispersion was prepared by stirring the biliquid foam into the aqueous polymer immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 1	73.85	8.7
PVP K30 (30% by weight in demineralized water)	465.9	54.8
Mowiol (5% by weight in demineralized water)	310.6	36.5
Total	850.4	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	26%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	210°C/110°C
Yield	about 100%
Comment	
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Little visible oil.
Mean droplet size before spraying	6.1μm peak at 11μm.

EXAMPLE 3

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymer immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 1	100	11.7
Water	74.64	8.7
Maltodextrin (40% by weight in demineralized water)	52.5	6.1
PVP k30 (30% by weight in demineralized water)	630	73.5
Total	847.14	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	185°C/85°C increased to 90°c
Yield	17.2%
Comment	Product slightly damp initially but spray dried well with higher outlet temperature.
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Slight amount of loose oil visible.
Mean droplet size before spraying	1.2μm peak at 9μm.

EXAMPLE 4

The dispersion was prepared by stirring the biliquid foam and make up water into the aqueous polymer immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 2	116.67	11.67
Water	66.67	6.67
PVP K30 (30% by weight in demineralized water)	816.67	81.67
Total	1000	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	203°C/95°C
Yield	64.21%
Comment	
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Little visible free oil.
Mean droplet size before spraying	0.58μm, peaks at 0.15, 0.7 and 12μm.

EXAMPLE 5

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 3	89.9	11.7
Water	67.1	8.7
Maltodextrin (40% by weight in demineralized water)	47.2	6.1
PVP k30 (30% by weight in demineralized water)	566.6	73.5
Total	770.9	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	195°C/95°C
Yield	56.6%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	No visible oil on surface
Mean droplet size before spraying	9.9μm

EXAMPLE 6

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 4	105.4	13.7
Water	48.8	6.3
Maltodextrin (40% by weight in demineralized water)	614.7	79.9
Total	768.9	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	45%
Oil: polymer (dry basis)	27.8 : 72.2
Inlet/outlet temperature	195°C/95°C
Yield	about 100%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Little visible oil.
Mean droplet size before spraying	1.4μm

EXAMPLE 7

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 4	101.7	11.7
Water	147.1	16.9
Maltodextrin (40% by weight in demineralized water)	266.9	30.6
Gum acacia	355.9	40.8
Total	871.6	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	195°C/95°C
Yield	78.3%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Little visible oil at surface.
Mean droplet size before spraying	1.3μm

EXAMPLE 8

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 5	81.4	11.7
Water	89.3	12.8
Maltodextrin (40% by weight in demineralized water)	128.3	18.4
PVP k30 (30% by weight in demineralized water)	399.1	57.2
Total	698.1	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	195°C/95°C
Yield	66.1%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	No visible oil at surface
Mean droplet size before spraying	0.95μm peaks at 1μm and 6.5μm

EXAMPLE 9

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymer immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 6	100	11.7
Water	74.64	8.7
Maltodextrin (40% by weight in demineralized water)	52.5	6.1
PVP k30 (30% by weight in demineralized water)	630	73.5
Total	857.14	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	175°C/95°C
Yield	92%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Minimal free oil visible on surface.
Mean droplet size before spraying	0.7μm, peak at 10μm

EXAMPLE 10

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 7	89.9	11.7
Water	67.1	8.7
Maltodextrin (40% by weight in demineralized water)	47.2	6.1
PVP k30 (30% by weight in demineralized water)	566.6	73.5
Total	770.9	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	195°C/90°C
Yield	93.8%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Little visible oil on surface.
Mean droplet size before spraying	2.39μm peaks at 1.5μm and 7.5μm

EXAMPLE 11

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 8	67.2	11.3
Water	50.2	8.5
Maltodextrin (40% by weight in demineralized water)	53.3	9.0
PVP k30 (30% by weight in demineralized water)	423.3	71.3
Total	594	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	29:71
Inlet/outlet temperature	195°C/95°C
Yield	82.3%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	No visible free oil
Mean droplet size before spraying	7.26μm, peak at 11μm

EXAMPLE 12

The dispersion was prepared by stirring the biliquid foam and water into the aqueous polymers immediately before spray drying.

Ingredients	Weight (g)	%
Preparation 9	79.1	11.7
Water	59.1	8.7
Maltodextrin (40% by weight in demineralized water)	41.5	6.1
PVP k30 (30% by weight in demineralized water)	498.5	73.5
Total	678.1	100

Spray drying conditions	
Pilot plant	Tests were carried out in a 1m diameter pilot spray drying tower with downward co current air flow. Atomisation was carried out with a two fluid nozzle.
Total non volatiles	35%
Oil: polymer (dry basis)	30:70
Inlet/outlet temperature	195°C/98°C
Yield	76.5%
Comment	Spray dried well
Product Characterisation	
Nature of dry particle	Good
Oil encapsulation	Good
Oil release	Minimal free oil visible on surface.
Mean droplet size before spraying	18.71μm

Footnote to the Examples

Trade Name	Supplier	INCI Name
Dow Corning 200 50cst	Dow Corning	Silicone
Etocas 25	Croda Chemicals	PEG-25 Castor Oil
Gransil DMCM-5	Grant Chemicals	Cyclopentasiloxane (D5) (and) Polysilicone-11 (and) Dimethicone. (An Organopolysiloxane mixture)
Gransil GCM-5	Grant Chemicals	Cyclopentasiloxane (D5) (and) Polysilicone-11 (An Organopoly-siloxane mixture)
Isopar K	Exxon Chemical Ltd	Isoparaffin
Kathon ICG 11	Chesham Chemicals Limited	Mixture of: 5-chloro 2-methyl-4-isothia-zolin-3-one and 2-methyl-4-isothiazolin-3-one
KMC	Rutgers Kureha Solvents GmbH	Diisopropylnaphthalene isomers (mixture)
Mowiol 4-88	Kuraray Specialties Europe	Polyvinyl alcohol, partly saponified
Pergascript red I-6B	Ciba Specialties	Bisindolylphthalide compound
Tween 20	Fisher Chemicals	Polysorbate 20

WE CLAIM:

1. A discrete powder which comprises particles in which a biliquid foam has been entrapped within a matrix of a polymeric material.

2. A powder as claimed in claim 1 which is a spray dried powder.

3. A powder as claimed in claim 1 or claim 2 which has a particle size in the range of from 5 to 100μm.

4. A powder as claimed in any one of the preceding claims wherein the polymeric material encapsulating the biliquid foam is selected from carboxymethylcellulose, hydroxyethylcellulose, cetylhydroxycellulose, hydroxypropylcellulose, hydroxypropylmethylcellulose, hydroxyethylmethylcellulose methylcellulose, gelatin, gum arabic, gum acacia, gellan gum, shellac, carragenan, natural starch, modified starch, xanthan gum, an alginate, a dextrin, polyvinyl alcohol, polyvinylpyrollidone or a polyamide, or mixtures thereof.

5. A powder as claimed in any one of the preceding claims wherein the biliquid foam comprises an substantially water immiscible internal oil phase which comprises a cyclomethicone, dimethicone, phenyl trimethicone, di-methiconol, dimethicone copolyol, trimethylsiloxysilicate, isopropyl isostearate, lanolate, myristate or palmitate, or octyl palmitate, avocado oil, coconut oil, soybean oil or sunflower oil, a caprylic/capric triglyceride, a lanolin oil, orange oil, mineral oil or natural oil, or oleyl alcohol or mixtures thereof.

6. A powder as claimed in claim 5 which comprises from 20% to 40% by weight of an oil, based upon the weight of the powder.

7. A process for the preparation of a discrete powder which comprises a biliquid foam entrapped within a matrix of a polymeric material, which process comprises the steps of:

i) preparing a biliquid foam,

ii) forming a dispersion of the biliquid foam in an aqueous solution, suspension or dispersion of a polymeric material, and

iii) subjecting the dispersion to drying under conditions such that a discrete powder is formed.

8. A process as claimed in claim 7 wherein the drying is carried out by spray drying of the dispersion.

9. A process as claimed in claim 7 or claim 8 wherein the biliquid foam prepared in step (i) has a droplet size in the range of from 5 to 40 micrometres.

10. A process as claimed in claim 7 wherein the biliquid foam has a droplet size of below 12 micrometres.

11. A process as claimed in any one of claims 7 to 9 wherein the polymeric material is selected from selected from carboxymethylcellulose, hydroxyethyl-cellulose, cetylhydroxycellulose, hydroxypropyl-cellulose, hydroxypropylmethylcellulose, hydroxyethyl-methylcellulose, methylcellulose, gelatin, gum arabic, gum acacia, gellan gum, shellac, carragenan, natural starch, modified starch, xanthan gum, an alginate, a dextrin, polyvinyl alcohol, polyvinylpyrollidone or a

polyamide, or mixtures thereof.

12. A process as claimed in any one of claims 7 to 11 wherein the biliquid foam comprises an essentially water immiscible internal oil phase which comprises a cyclomethicone, di-methicone, phenyl trimethicone, dimethiconol, di-methicone copolyol, trimethylsiloxysilicate, isopropyl isostearate, lanolate, myristate or palmitate, octyl palmitate, avocado oil, coconut oil, soybean oil or sunflower oil, a caprylic/capric tri-glyceride, a lanolin oil, orange oil, mineral oil or natural oil, or oleyl alcohol, or mixtures thereof.

13. A process as claimed in any one of claims 7 to 11 wherein the continuous phase of the biliquid foam is an aqueous phase.

14. A process as claimed in any one of claims 7 to 13 wherein the aqueous phase includes therein a C_1-C_4 alcohol or ethylene glycol.

15. A process as claimed in any one of claims 7 to 13 wherein the spray drying conditions comprise an inlet temperature in the range of from 180 to 210°C and an outlet temperature in the range of from 85 to 100°C.

16. A process as claimed in any one of claims 7 to 15 wherein the discrete powder has a particle size in the range of from 5 to 100μm.